Silviculture

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Wood - it is the heart of British Columbia

INTRODUCTION

When furs and gold drew the first settlers to British Columbia, the forests were in the way, impediments to travel and settlement. By the early part of this century the railroad had tapped the resources of the Canadian West and the Panama Canal had opened up the wood-hungry markets of the world. British Columbia's timber boom was under way.

The settlements that grew around the early logging camps and sawmills are the towns and cities of today and they still depend on wood — it is the heart of British Columbia. British Columbia's forests provide employment for one-quarter of the work force. The forest industry generates a payroll of about $2 billion a year and accounts for a substantial percentage of provincial government revenues which provide roads, education, health care and other public services.

But the growth of British Columbia has taken its toll on the forests. In the beginning, they seemed endless. Today, the vast, old growth forests are dwindling and the province is in the midst of a transition to younger forests with smaller trees.

Part of that transition is known as the falldown effect: the reduction in timber volume when a forest is harvested at a younger age. One hectare of 300-year-old coastal forest provides about 750 cubic metres of wood — the same area at 80 years may only yield 500 cubic metres.

To compound the problem of smaller trees there is a smaller forest land base. British Columbia's forests are shrinking. The forests have been pushed back to make room for the province's growth and economic diversification. Roads, dams, farms, transmission corridors, shopping centres, housing developments, new industries — all diminish the forest land base.

In British Columbia, less wood means fewer jobs, less government revenue, less money in circulation. It means economic trouble.

But the value of the forests can not be measured solely in economic terms. They provide shelter and forage for wildlife, and grazing for cattle. Their rivers and streams provide fresh water, and spawning beds for salmon and other fish. And the forests are an important source of recreational and aesthetic pleasure.

British Columbia is facing two major challenges in its forests today: to manage the forests so they will continue to provide the economic, environmental and social benefits on which the province depends; and to do this on a limited land base.

The vast old growth forests are rapidly becoming a thing of the past for commercial purposes.

Silviculture is the science, and art, of cultivating the forest

SILVICULTURE—An Overview

The British Columbia Ministry of Forests administers 94% of the province's forest lands and is responsible for managing the forests to ensure their productivity and preserve the network of values associated with them.

Silviculture (from the Latin *silva*, meaning forest) is the science, and art, of cultivating the forest. The silvicultural process begins before the forest crop is harvested with site assessment and planning the new crop to be grown, and encompasses the re-establishment and tending of the new forest.

British Columbia's silvicultural efforts are directed towards growing better trees, faster. Silviculture is not the whole answer, but along with increased protection and better utilization, it has a significant role to play in a successful transition to healthy, productive forests tomorrow.

Silvicultural Planning

In 1980, the Ministry of Forests introduced a new system of forest resource planning and programming. Annually updated five-year programs provide a comprehensive blueprint for present action which will produce more and better trees in the future. The five-year program identifies forest and range resource goals, the work needed to achieve them and anticipated costs.

Each year the five-year program is reviewed and assessed and a plan for a new, fifth year is added. The first five-year program calls for a level of achievement to be reached by 1984-85 and envisages a steady acceleration in silviculture.

The current five-year goal of the silviculture program is to enhance timber production by about 13 million cubic metres.

Establishing New Forests

One of the major thrusts of the province's silviculture program is the prompt regeneration of forests that have been logged or destroyed by fire or other natural causes. The current goal is to have new forests established within one to ten years, depending on the nature and location of the land.

The establishment of new forests requires site preparation, tree planting or natural regeneration, weeding and brush control. These *basic* silviculture treatments are expected to add 7 million cubic metres to future wood supplies.

Nursery Production

The province needs more seedlings to meet its expanded planting targets. In 1981, 97 million seedlings were planted, produced by government and private nurseries. The goal for 1985 is 131 million. The Ministry of Forests is encouraging private participation to meet the seedling production requirements of the resource program.

Seed Orchards

About five per cent of the seedlings planted in British Columbia in 1981 came from seed produced by genetically superior trees cultivated in government and industry seed orchards. The goal is to provide orchard seed for nearly half the total seedlings planted in the province.

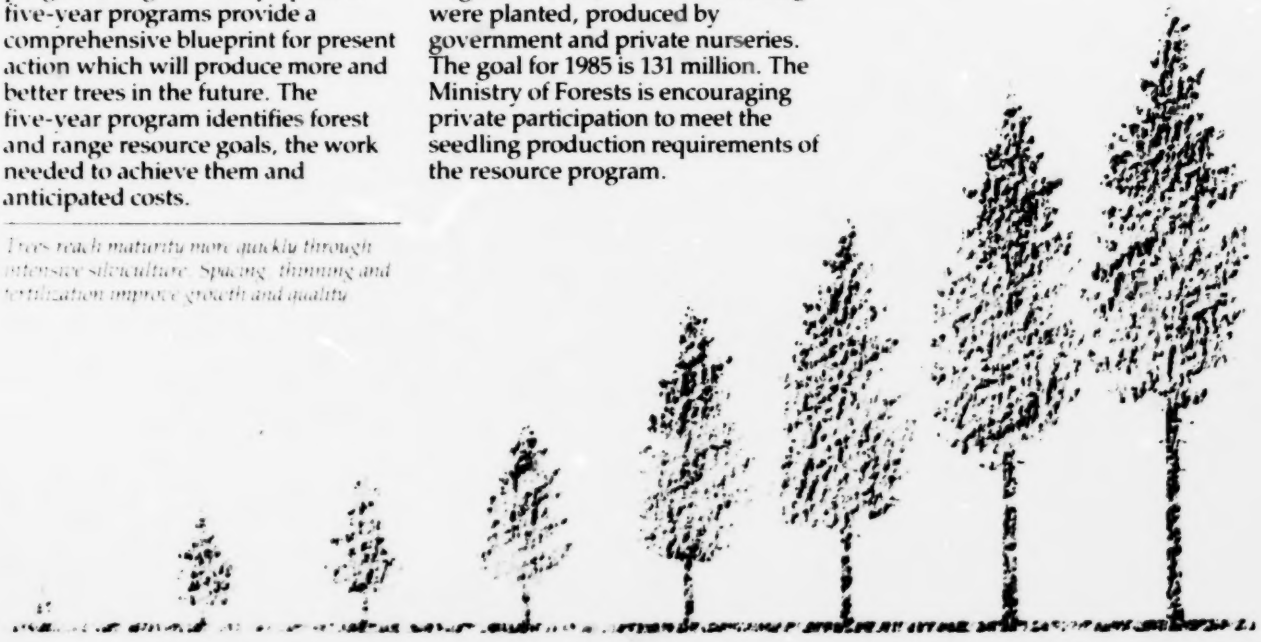
Intensive Silviculture

Intensive silviculture involves tending new forests after they have become established. It includes spacing, thinning, conifer release and fertilization, as well as backlog reforestation — the rehabilitation and planting of forest land which is not producing an adequate tree crop.

By 1985, the 1981 level of intensive silvicultural treatments will be tripled.

Research Support

To support these new programs, on-going research is furthering understanding of forest ecosystems, tree improvement, seedling production and other aspects of silviculture. This research is essential if the established goals are to be reached.



Trees reach maturity more quickly through intensive silviculture. Spacing, thinning and fertilization improve growth and quality.

SILVICULTURE — The Process

HARVESTING

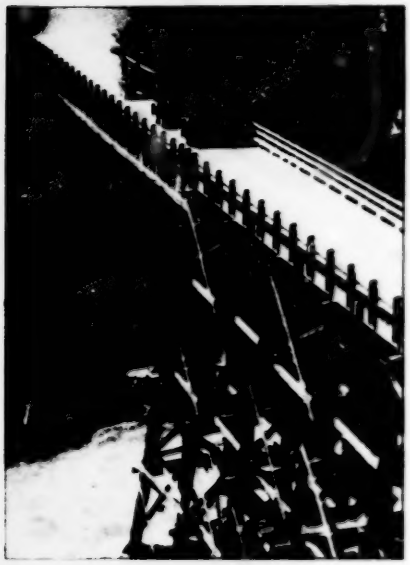
Management & Development Plans

Before forest companies can harvest an area, their management and development plans must be approved by the ministry, and a cutting permit issued.

These plans provide details about the site itself: its topography and soil types; the species of trees it grows; and its water, fish and wildlife resources. The plan also describes the proposed location of roads, the method and timing of harvest, any projected silviculture activities and protection measures.

Environmental Assessment

Before logging begins foresters carefully assess its environmental impact. Special treatments may be prescribed for watersheds, sites around salmon spawning streams and areas that support a significant wildlife population. Delicate sites with very steep slopes or thin soil are also protected. In some cases, logging is prohibited or deferred.



Management and development plans include the proposed location of roads and bridges. Water crossings are to be considered in these plans and protected.

Harvesting Systems

The preferred harvesting method in British Columbia is clear cutting, in which the entire stand is felled. Clear cutting makes good economic sense, given: the size of the trees; the overmature and decadent nature of many stands; the size of the equipment needed to remove the trees; and the distance the crews have to be transported. In many areas, clear cutting also enables more efficient and effective reforestation.

The usual alternative to clear cutting is selective logging which can only be used when young seedlings can thrive under shade. With this method only selected trees are removed from a stand, normally resulting in an even distribution of trees of every age. Selective logging accounts for approximately one fifth of the Interior's forest harvest.

Another logging method is the shelterwood system, which is often used to allow a stand to regenerate naturally by leaving selected trees to produce seed and provide shade for the new forest. When young trees are established, the seed trees are removed. Again the young trees must be able to thrive in the shade; which rules out coastal Douglas-fir, for example.

In most of British Columbia's forests, the nature of the terrain and the size of the trees make it necessary for skilled personnel to fall trees with power saws. Falling is a hazardous occupation, requiring a nice blend of technique and judgement to bring the tree down accurately, without damaging it or surrounding trees.

In the province's interior forests, where the trees are smaller and the terrain flatter, falling can often be done with large, mechanical shears that cut the trees off at their base.

Removal

On steep terrain, the high-lead logging method is used to lift the logs from the forest floor to a landing where they will be loaded onto trucks. High-lead logging employs a mobile tower, or "spar", to which cables are attached. Chokermen fasten the cables around the logs, which are then skidded or lifted to the landing.

On flatter terrain, rubber-tired skidders are used to drag the logs to the landing.

Road Construction

Forest roads are essential, not only to provide access for the actual harvest, but also to open up areas for silvicultural projects. They also open the forest to recreationists and other resource users.

The roads, however, make a major impact on the forests. They must be engineered with care to prevent erosion of steep slopes and siltation of streams. In areas of the interior where soil or other features are particularly sensitive, logging is often done in winter on roads built on a base of hard-packed snow.

Roads also remove land from the forest base. Every kilometre of logging road represents another strip of land which cannot be used to grow trees. Thus the benefits derived from road construction must be balanced against the land it takes out of production.

Reforestation is planting the right trees on the right side in the right way to obtain the best possible crop

REFORESTATION

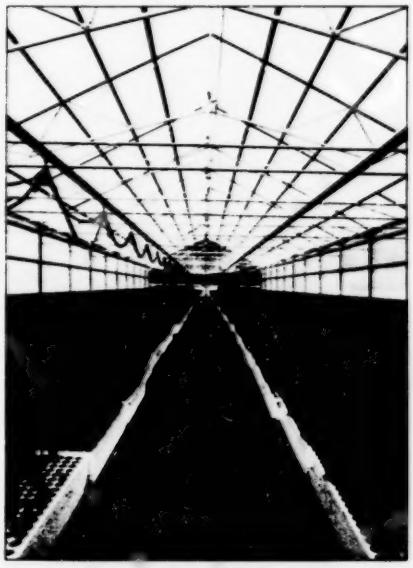
Most logging sites will, if left undeveloped, regenerate naturally. But it is a long, uncertain process, taking up to 40 years for new seedlings to establish themselves — and some never do. About half of the forests logged in British Columbia regenerate naturally within about 10 years, provided they are adequately prepared. For the remainder, man must take a hand in reforestation. Trees are too important to wait for nature to take its slow course, and it is essential to both the economy and the environment to establish new forest growth as rapidly as possible.

Reforestation is much more than simply planting trees. It is planting the right trees on the right site in the right way to obtain the best possible crop.

Reforestation did not begin in British Columbia on a significant scale until 1930, and its techniques are still evolving today.

Tree breeders are developing fast growing, well formed strains of trees to produce the seed for the new forests. Forest ecologists and other researchers are developing more detailed and precise analyses of forest ecosystems. These provide silviculturists with the ecological tools to determine which species are most suitable for which site. And nurseries are adopting a wide range of methods to raise various B.C. species and stock types so as to enhance their chances of survival and growth after planting.

New nurseries are also being built, existing ministry facilities expanded, and private nurseries are entering the seedling production program to meet the requirements of British Columbia's ambitious reforestation program. In 1930, the first reforestation program planted 65,000 seedlings; in 1981-82, the first year of the province's five-year resource program, 75 million seedlings were planted on Crown lands. By 1986 the plan is to plant 131 million seedlings.



The modern nursery provides a controlled environment. This enables the nursery technician to better prepare seedlings for the field.

Site Surveying

After an area has been harvested, or in some cases before logging begins, foresters and technicians decide what the next tree crop will be and how it will be grown.

They prepare a silvicultural prescription outlining the steps that must be taken to grow a healthy new crop, and their prescription is based on the capabilities of the forest site.

They first determine whether or not the site needs preparation before it can receive a new crop, or whether it can be left untouched. They must determine whether the forest can regenerate naturally, or whether it should be planted. If planting is necessary, they must select the best species and type of seedling, then decide how, and when, they should be planted.

Foresters may do a number of surveys of a specific site, then return during the re-establishment phase to see how their prescription is working, and revise it if necessary.

Ecosystem Classification

The method of site preparation and the species selected for each new forest must be determined by the ecosystem of the specific site.

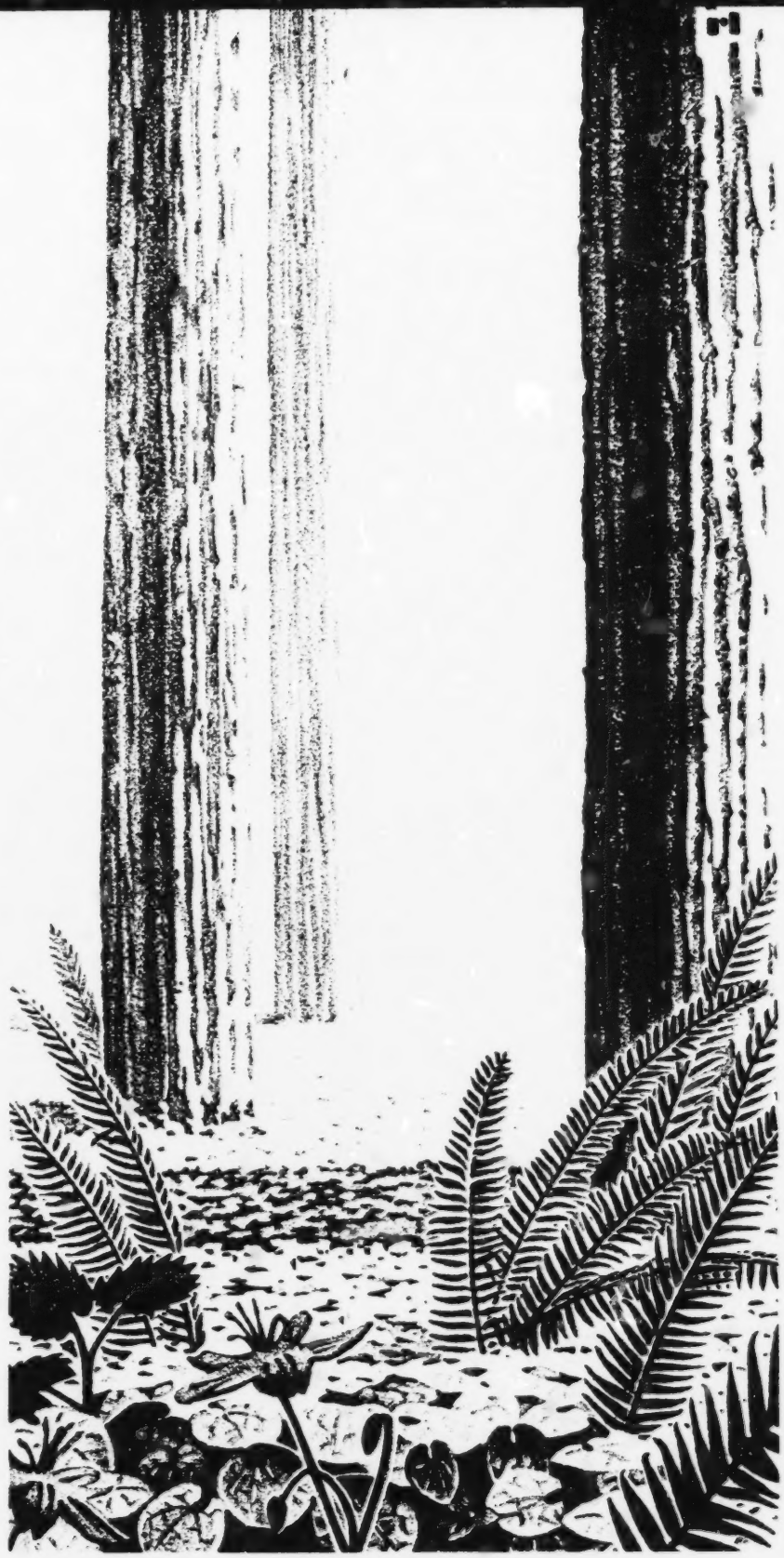
The site's elevation, aspect (north or south), drainage, the depth and composition of its soil, the steepness of its slope, climatic conditions and the health of the harvested stand are all considered. These form a network of relationships which determines site treatment, composition and the ultimate success of the new forest.

The process of comprehensive ecosystem classification breaks the province into a number of biogeoclimatic zones (pertaining to the biological, geographical and climatic components of the ecosystem), each characterized by a dominant tree species.

Minor vegetation is an excellent ecosystem indicator whose use as such is still relatively new in B.C. Foresters identify the shrubs and herbs which grow naturally on the site, and use them as an interpretive guide to the biological, geographical and climatic factors which determine the types of conifers the site will support. All this information is translated into a moisture and nutrient summary, or edatopic grid, which is used by the foresters to make decisions on site regeneration.

If, for example, the elevation is low, and the area is marshy, supporting plants like skunk cabbage — western red cedar or Sitka spruce are likely to thrive. If, on the other hand, the site is half way up a mountain, with well drained soil, covered with salal — the obvious choice is Douglas fir.

Once the field practitioner is proficient in identifying key indicator plants the procedure is simple to use; however it has taken many years to develop the interpretative system. Data is still being collected to refine and expand it to encompass all the regions of the province.



The presence of Siberian miner's lettuce, sword fern, or salal is a good indication that the surrounding area is a productive ecosystem for the growth of Douglas fir. Before deciding which species would best grow on the site, however, a forester would first identify a number of other shrubs, herbs and mosses, as well as take a good look at the soil.

Broadcast burning requires extreme care and is only carried out on sites for which it is a positive benefit.

Species Selection

Until the early 1970s, Douglas fir was virtually the only species planted in south coastal British Columbia. There were several reasons for this choice: the species is easy to grow from seed, is hardy and fast growing and it produces high quality wood.

Progressive indicators such as the ecological classification system have shown that there are many sites that simply will not support Douglas fir. Provincially, Douglas fir now comprises less than 20 per cent of the total seedlings planted while more than half are interior spruce species. Hemlock and lodgepole pine make up most of the balance. Other species include cedar, balsam fir, larch and ponderosa pine.

Often the previous stand is not the most desirable crop, for a number of reasons. Another species may perform even better on the site or produce more wood, or better quality wood.

It might even be desirable to plant a mixture of species that will better utilize the site's growth potential, and provide future options for management.

After foresters have identified the species required for the specific site, a further complexity enters the equation: it is not enough simply to select the right species — the right seed has to be chosen. The best results are achieved with seed produced by trees from an ecosystem and elevation similar to the site to be reforested. In fact, if the growing conditions of the parent tree are too different, the seedling may not be able to adapt to the new site.

For example, seed taken from a Douglas fir growing at sea level in a mild coastal climate will not produce seedlings that have a good chance of surviving in the interior of the province, even though the site contains a stand of Douglas fir that appears identical. The seed from the coastal tree will be programmed genetically to produce a tree that requires an eight month growing season and the Interior cold will likely kill it.

With the right prescription of species and seed provenance the site is well on its way to a new forest.

Site Preparation

Whether a logged-over site is to be planted or left to regenerate naturally, the new forest crop will often achieve a better, faster start if the land is prepared to receive it.

Site preparation involves removing or redistributing slash — branches, tree tops and other logging debris which cover planting spots and obstruct the movement of planters. It also reduces fire hazard.

Site preparation exposes the mineral soil new trees need to take root and grow. The forest floor is often covered with a deep layer of duff — needles and other fine debris which cover the mineral-layer below. If this layer is too deep, the roots of young seedlings cannot take hold or receive the nutrients and moisture they require.

There are several methods of site preparation, all seeking the same objective, though the method selected is tailored to the needs of the given site. Soil, elevation, steepness, species to be grown and natural productivity are all taken into account.

BROADCAST BURNING:

Burning is often nature's way of preparing the ground for a new crop — in broadcast burning man is emulating nature. Douglas fir does particularly well on burned-over sites.

In a broadcast burn logging slash is ignited and the entire area burned. It is by far the most common method of site preparation used in British Columbia.

Before prescribing a burn, the silviculturist must evaluate soil type and depth to ensure that the soil mantle can withstand fire. Fires must be controlled as carefully as possible to retain the organic soil layer in sufficient quantities to support the new forest. Of course, precautions must also be taken to ensure that the fire does not spread into adjacent forests.

Seed is often collected with specialized baskets slung beneath helicopters.

MECHANICAL SCARIFICATION:

Mechanical scarification is a common means of site preparation in Interior forests. A bulldozer or skidder is used, equipped with a toothed ripper blade, dragging heavy anchor chains or spiked drums. These devices crush logging debris, redistribute it over the site, loosen humus and mix it with the underlying mineral soil.

Scarification promotes natural regeneration of species like lodgepole pine, by creating the right conditions for cones to open and release their seeds. Cone-bearing branches are broken down and distributed over the ground and the vegetation which shades the cones is displaced. The combination of direct sunlight and heat radiating upward from the ground opens the cones. Scarification also reduces fire hazard.

WINDROWING:

When logging debris is heavy and a broadcast burn hard to control, the site can be prepared by windrowing. A bulldozer pushes the slash into rows or piles which are burnable with greater control.

A shark fin scarifier is commonly used to prepare a site for planting.

Seed Collection

Most seedlings planted in British Columbia today are grown from seed produced naturally in the forest. Cones are collected and their seed is extracted, tested and stored at the ministry's seed centre at Duncan. It is then directed to nurseries upon request where it is sown to produce seedlings.

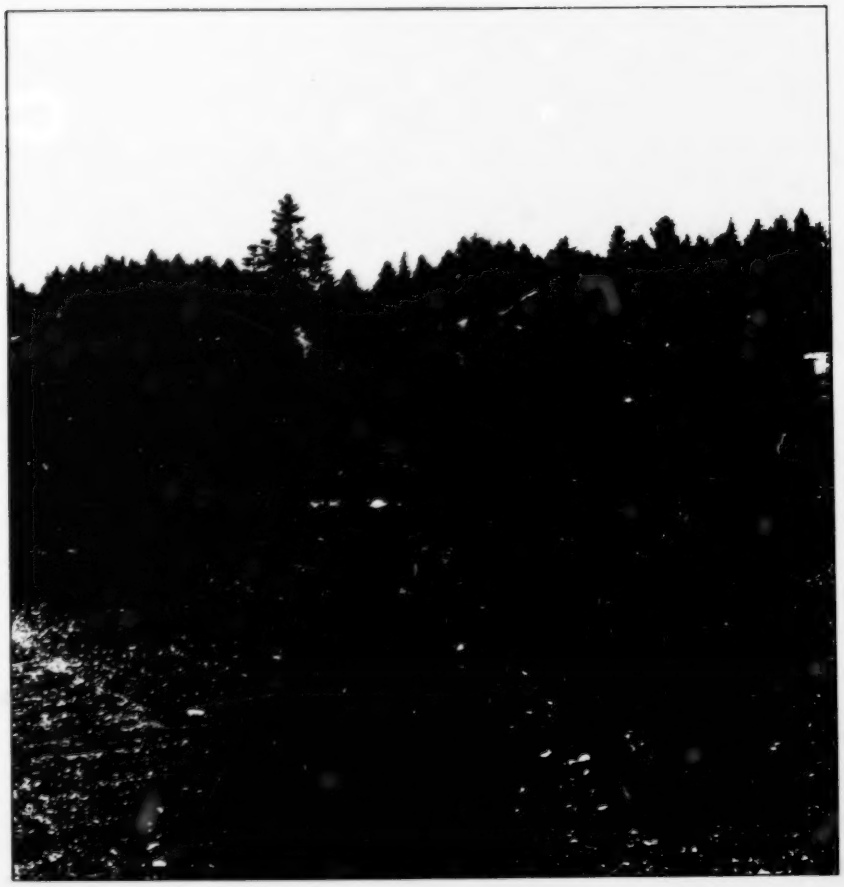
Careful records of the seed's *provenance*, or geographic origin, is essential to successful performance of nursery-raised seedlings.

Cone collecting requires the marshalling of a great deal of manpower and equipment and thus is normally done in years when trees produce an abundant cone crop. There can be intervals of up to 15 years between cone crops which are abundant enough to warrant collecting. Seed is kept for years in cold storage to supply nurseries well into the future.

In crop years, crews with sacks and rakes strip cones from branches of trees selected and felled for cone harvest. This is usually done in active logging areas. Sometimes machines are used to shake the cones from standing trees or pickers are employed to climb the trees and remove cones from the upper crowns.

In recent years, helicopters have provided an efficient method of cone collecting. A basket, open in the centre, is lowered onto the crown of the tree. The opening has rake-like teeth which, as the helicopter pulls the basket back up the tree, strip the cones from the branches and drop them into the basket.

Seed is extracted from the cone in a process which involves heating the cones in a kiln and shaking. All wings and other debris are removed and the seed is tested for germination ability, then placed in cold storage vaults until needed for sowing in forest nurseries. Prior to sowing it is soaked in water for a day, dried and kept at a steady, very cool temperature for about a month. This helps the seed batches to germinate uniformly.



Tree Improvement

About five per cent of the seedlings currently planted in British Columbia come from seed orchards where tree breeders are striving to produce increasing numbers of genetically superior parent trees.

The province's tree improvement program began in 1957 with the identification of the first "plus" trees: naturally growing trees which were the best looking specimens of their kind — tall and straight with thick trunks having slight taper and a fine branching habit.

Foresters search the woods for plus trees, mark them with paint and record their locations. In winter, when the trees are dormant, crews return for scions (the outermost tips of the branches) which are shot from the tree with a rifle.

Scions are grafted onto root stock or, with some species, grown as rooted cuttings. These are clones of the plus trees — genetically identical to the tree from which the scion was taken — and become the seed trees planted in the orchard.

When the clones in the seed orchard begin to produce flowers and pollen, tree breeders cross them under carefully controlled conditions. The female flowers are enclosed in paper bags to protect them from random pollenation and plus tree pollen is injected into the bags with a hypodermic needle, enabling precise genetic control of the seed produced.

The seed is sown in nurseries to produce stock for progeny testing in various logged sites. When foresters select plus trees, they have no way of knowing whether the tree became a prime specimen because it was genetically superior, or because it had an advantageous growing environment.

The only way tree breeders can be sure is by monitoring the growth of the tree's offspring, or progeny. If seedlings grown from plus tree seed do well in most forest environments, they know the parent is genetically superior. If the seedlings do poorly, they realize the apparently superior parent was an accident of its environment and its clones are removed from the seed orchard.

Tree improvement is a long, slow process, but tree breeders anticipate that forests originating from genetically superior seed will cut 10 to 20 years off the time it takes forests grown from unimproved seed to produce a marketable crop.

It is the goal of the tree improvement program to provide enough genetically superior seed to produce 120 million seedlings a year by 1995.

(top) Water sprayed on the seed orchard helps prevent wild pollen from contaminating the orchard.
(above) Pollination is controlled using bags into which pollen from a 'plus tree' is injected

Nurseries

By 1986, British Columbia's nurseries will be producing 131 million seedlings a year to restock logged and burned-over sites. That figure represents a 38% increase in seedling production in a five-year period.

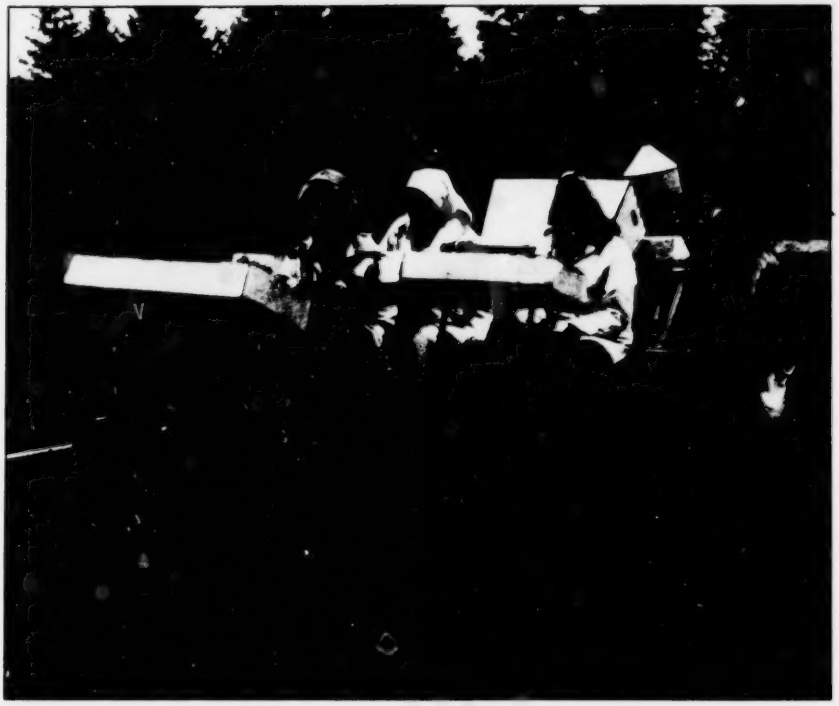
Seedling production was formerly limited to government nurseries, but in 1980 private enterprise was invited to participate, and as a result, production capacity is expanding rapidly. By 1986 approximately 1/3 of the provinces seedling requirement for crown land reforestation will be produced in private nurseries. The ministry is also encouraging greater regionalization of nurseries, especially in the Prince George and Prince Rupert regions, where the bulk of increased production is required.

Nursery seedlings must be carefully prepared for life in the wild — a tall order. It means growing them to precise standards.

Bare-root seedlings, grown outside, are treated according to prescriptions tailored to the species. Each receives its own mix of fertilizers, applied at different stages of development. Proper watering is essential. Roots must be undercut and pruned at intervals, to further improve their growth. They may even be transplanted for a third year's preparation for harsh conditions.

Progress is closely checked, especially during the first months. If they are not developing on schedule the feeding, watering or root-pruning of the next crop may have to be modified. This fine tuning has greatly improved the quality of seedlings over the years.

Styrofoam containers are a preferred system for growing seedlings of certain species such as



(top) Seedlings are set out for bareroot production.
(right) Millions of seedlings are grown in special containers in greenhouses and shade frames.

hemlock and red cedar and are effectively used to grow all species in the reforestation program. Grown under cover, container seedlings, or "plugs", are easily packed and handled and are less likely to be damaged during transport and planting. This increases their chances of survival in the wild. Containers are now used to grow about half of the seedlings planted in B.C.
can accommodate thousands of seedling containers. Automatic irrigation systems fertilize and water the seedlings to prescribed specifications. The covered environment provides variable climate control; from basic shelter, to full heat, light and moisture control in the greenhouses. This enables the nurseryman to prepare his crop for life in the forest with considerable precision.

Seedlings are prepared for shipping in the winter months when they are dormant. They are lifted from nursery beds or extracted from their containers, quickly bundled together and carefully packed in boxes. These can be shipped at once to the field for planting or stored in large cold-rooms until spring, when most planting operations begin.

Tree Planting

Every year, hundreds of tree-planting projects are let to small silvicultural contracting enterprises by the Ministry of Forests and forest companies. Some is done by crews hired locally.

In the spring, as soon as the snow leaves the ground, the planting crews go to work. They begin at lower, warmer elevations on the coast and move higher up the mountains or into the interior as the snow disappears. Most of the planting in British Columbia is done between April and June although it can begin as early as February on the coast. When conditions are right, limited planting is resumed for about a month in the fall.

Each seedling is individually and carefully planted. They must be spaced about 2.5 to 4 meters apart

Tree planting is hard work requiring skill and patience.

and their growth must not be hampered by rocks or debris. The planters must clear away the duff (organic) layer to place the seedlings' roots in the mineral soil below, ensuring that the soil is deep enough to hold the small tree and adequately cover its roots.

With bare-root stock, the planter digs a small hole with a mattock, spreads out the roots and firms the earth down around them. With plugs, the planter pokes a hole in the soil with a tool called a dibble or a mattock and inserts the shaped root which is held together by the growing medium.

Twelve hundred seedlings to the hectare is the norm for tree planting and, if the seedlings are all planted properly and are not eaten by deer, injured by late spring frost, subjected to prolonged summer drought or choked by brush, the plantation should produce a mature forest of about 700 to 800 trees per hectare.

Growing and planting seedlings is a delicate task, but quality control and the application of new techniques are improving survival rates.

Plantation Assessment

The establishment of a new plantation is a combination of biological and human effort and as little as possible is left to chance. A lot of time and money can be wasted if trees are poorly planted. As soon as the seedlings have been planted, staff from the Ministry of Forests or forest companies make a quality inspection to ensure the planting has been done properly.

After the first growing season, and sometimes again after the second and third seasons, survival and performance assessments are made. If seedlings are dying, or not growing as rapidly as they should, some form of follow-up treatment will be prescribed. The treatment could involve brush control, or perhaps a second planting.

A planting report is prepared for every new plantation. This includes a biological assessment of the site, information about site preparation, the species planted and the nursery the seedlings came from. This data is fed into a computer, along with information from any subsequent stand treatments, to form a complete history of the establishment and maintenance of the stand.

The very sites that produce the best crop of trees will also produce the most brush and weed

STAND TENDING

If a new plantation grows untended it will produce a crop of harvestable timber within 50 to 120 years. The application of intensive silvicultural techniques can significantly reduce this growth time.

Brushing and Weeding

Newly planted seedlings are often shaded or choked by fast-growing deciduous trees — alder and aspen for example —, various species of brush, or even some grasses which compete with the tiny conifers for sunlight, nutrients and growing space.

Unfortunately, the very sites which can produce the best crop of trees will also produce the most brush and weed. On new plantations these undesirable weed species must be temporarily controlled until new conifers are established. The preferred method is to apply herbicides to the competing species.

Only federally registered herbicides are used, under permit from the provincial Ministry of Environment, and applications are carefully controlled to protect both workers and the environment.

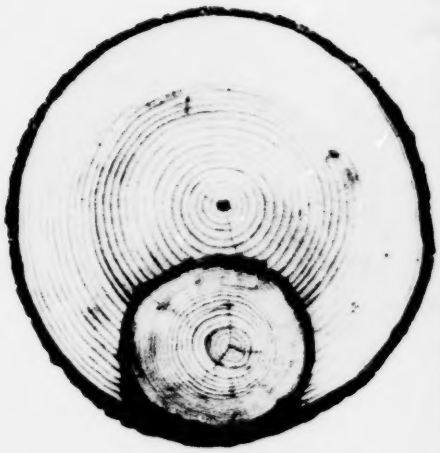
Forestry crews may cut back competing species with saws or brush cutting implements, but a high injury rate, frequent damage to the young conifers and proliferation of sprouts have made this method less satisfactory than chemical treatments.

Conifer Release

Once a coniferous stand is established, the growth of deciduous species is no longer a threat to its survival, but it can *slow* the growth of the immature stand.

In such cases, deciduous growth is cut back or chemically treated to release the conifers, usually when the stand is between 15 and 30 years old.

(above) The hack-and-squirt method rids a site of weed species through individual applications of herbicide.
(left) Spacing is carried out very early in the life of the plantation.



(above) The effects on stand tending are immediately apparent in these cross sections of trees of the same age.
(above right) Commercial thinning takes place when the stand first reaches a marketable size.

Juvenile Spacing

Throughout the life of the forest, trees compete for sunlight, air, moisture and nutrients. The crown of the tree is the factory that produces wood and, in an overcrowded stand where only the tree tops are exposed to sunlight, lower branches may die and greatly reduce the tree's ability to grow. If there are too many trees in a stand, none of them will achieve their full potential and the stand may stagnate as a result.

When a plantation is between 10 and 20 years old, it can be spaced to remove inferior trees and leave the biggest, healthiest and best-formed trees more room to grow. The remaining trees reach a uniform, merchantable size sooner with a higher value.

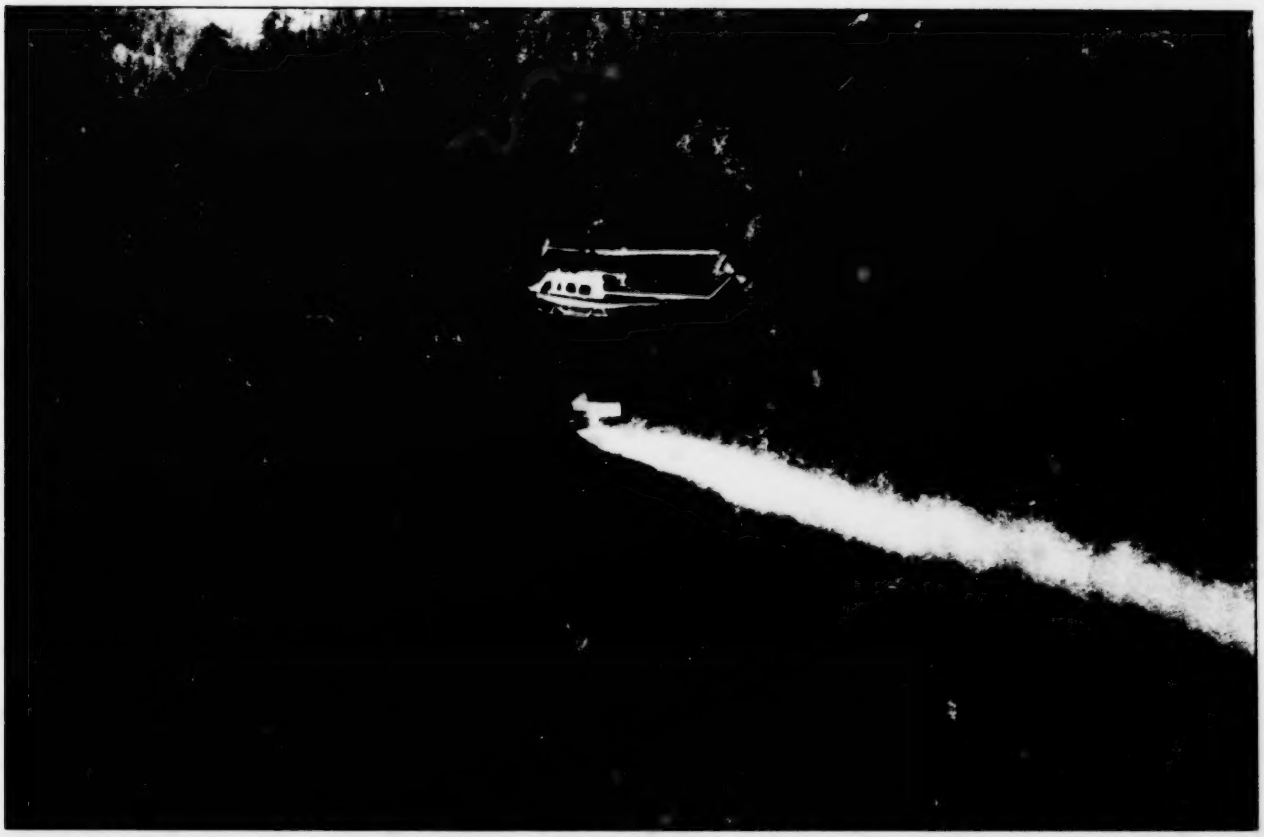
Trees are spaced at about 3.5-meter intervals and the fallen trees are left on the ground to decay and return nutrients to the soil.

Commercial Thinning

By the time a stand is between 30 and 40 years old, it may again be overcrowded with competing conifers whose growth has been stimulated by juvenile spacing.

Some of the trees will be of harvestable size, suited for small sawlogs or pulp. Commercial thinning removes selected trees to promote the growth of those that remain. Great care must be taken to ensure that crop trees are not damaged in the extraction process.

(below) Aerial fertilization is particularly effective on coastal Douglas fir, increasing growth by as much as 15 percent.



Fertilization

Fertilization combined with juvenile spacing can increase forest growth by as much as 15 per cent.

Trees need nitrogen to grow and, if the soil is deficient in this nutrient, an effective solution is to spread pellets of nitrogen fertilizer over the stand from the air. The effects of fertilization last about five years and the treatment may be repeated several times over the life of the stand.

Not all stands need to be fertilized, and not all species will respond. Fertilization has brought the highest performance gains in coastal Douglas fir.

Forest fertilization is relatively new in British Columbia, and further research may reveal more about this technique's potential to enhance forest growth.

Site Rehabilitation

Thousands of hectares of productive forest land which once supported high quality stands have not regenerated satisfactorily, or have been invaded by undesirable or non commercial species. In other instances stands have become decadent, or stagnated, and have little commercial value. These areas represent a significant loss in future yields if they are not replaced by vigorous new forests. In the recent forest analysis 1.3 million hectares were classified as unsatisfactorily restocked or occupied by brush. Seven times this area was considered decadent or stagnant.

Site rehabilitation is directed to the high yield sites. It requires that the existing cover be removed, utilized where possible and the site left in suitable condition to receive high quality seedlings which are usually planted the following spring. Some of the best coniferous growing sites in the province are occupied by low quality alder stands; the five-year program calls for conversion of many undeveloped sites to rapid growing coniferous species.

Silviculture will help ensure that British Columbia makes a successful transition to well managed second growth forests

INDUSTRY & GOVERNMENT

The British Columbia Ministry of Forests is responsible for the management of Crown forest lands in British Columbia (about 94 per cent of the province's forests). It achieves this with the cooperation of the forest industry.

The ministry establishes forest management policies and programs — in consultation with industry and other resource users. The actual work of forest management — tree planting, spacing and other silviculture treatments — is shared between government and industry.

Forest companies operating on Crown land in British Columbia pay [redacted] "stumpage", on the timber they harvest. Since the benefits of reforestation mean more timber for the landowner — the people of British Columbia — the owner foots the bill, reimbursing industry's reforestation expenses.

The ministry also provides an incentive for forest companies to apply more silvicultural treatments than are required under the terms of their licences. Companies which attain these gains in productivity may have the gains credited to the allowable annual cut authorized in the license.

Most industrial concerns recognize that whether silviculture actually increases the total forest yield or simply maintains existing production levels, it is an essential part of their economic well being and the province's.

THE FUTURE

The goal of the British Columbia Ministry of Forests' silviculture program is to carefully manage the province's forest lands in order to: (1) maintain the natural productivity of forest sites through proper harvesting practises; (2) ensure that thriving new forests quickly replace those denuded by logging, fire or pests; and (3) produce the biggest, healthiest trees as quickly as possible.

British Columbia's forests grow under some of the most diverse conditions in the world, ranging from semi-arid lands to northern boreal, to rain forest; from high elevation sub-alpine to sea level; with climates from temperate to continental, to sub-Arctic. Silviculture must be site-specific — a great deal more time and work is needed to further our understanding and improve our management skills.

In many respects, silviculturists are only beginning to understand the factors that affect the growth of trees. More data, more research and more field trials are needed. Much work remains to be done on ecosystem classification, to thoroughly analyse the ecology of each growing site; and more research is needed on tree improvement, so that more species can be regenerated from genetically superior seed. Seedling production processes, handling and planting techniques can be improved to enhance seedling survival and the effects of fertilization are not yet fully understood.

Silvicultural development is a lengthy process. The results of new treatments and field tests will not be apparent in the forest for many years. The potential of silviculture to enhance forest productivity is already well-documented elsewhere in the world, and many of British Columbia's forests are now also showing the benefits of treatment.

An increased emphasis on silviculture and the expansion of other forest management programs will ensure that, in time, British Columbia can meet the forest challenge of the coming years — to make the transition from harvesting old growth to obtaining increased yields from well managed, second growth forests. This will be absolutely necessary to meet projected timber supply requirements.

These forests will be managed not only to provide the stable, renewable production base that the forest industry requires, but to support the variety of resources valued by everyone in British Columbia.

POOR

QUALITY

ORIGINAL